National Park Service
U.S. Department of the Interior

Glacier National Park

# Student Reading

## *Unit 1: People and Glacier National Park*

## National Park designation- What does it mean for people?

Glacier National Park is an awe-inspiring place. Many aspects of this land are also sacred to the Blackfeet, Salish, Kootenai and Pend d'Oreille Tribes.[1,2] George Bird Grinnell and other conservationists lobbied Congress for seven years to protect the area as a national park. Grinnell felt that the establishment of Glacier National Park in 1910 would save the land from the development which was the fate of many other American Indian territories. With the discovery of minerals west of the Continental Divide, demand for more Blackfeet land increased. Not everyone agreed that this area should be made into a national park. Even today, there are people who do not think it was the right thing to do. What do you think?

Today, Glacier National Park is managed by the National Park Service. It is a federal agency whose mission is to preserve and protect the natural and cultural resources of the United States.

In 2014, over two million people from all over the world visited Glacier National Park. Most of those visitors come to the park in the summer. The park has roads, trails, campsites, and buildings.

These things were developed to make Glacier National Park accessible to visitors. It is park policy not to expand the developed areas within park boundaries. If a facility is updated, new construction must be done in existing developed areas. In fact, there are fewer roads and maintained trails in the park now then there were fifty years ago. Most of the park, over one million acres, is managed as wilderness.

How do you protect and preserve a wild place that has so many visitors? The National Park Service relies on people to be good stewards of the country's public lands. Still, this may mean creating regulations for where people can camp or hike. It also may limit the type of activities people can do in the park. In Glacier National Park, regulations forbid taking anything out of the park - rocks, flowers, sticks or firewood. Hunting is also not allowed in the park.

One way to teach people about caring for the earth is through story telling. Here is an example of a contemporary story that teaches about caring for the Earth.

"Glacier in Focus" student group at Apgar Campground, (Parks in Focus Photo, 2010).

Cover: "Parks in Focus" photo from student group at Logan Pass.

## Lucy Lone Walker - An example of a contemporary story about caring for the Earth

As near as she could tell, Lucy Lone Walker was almost 90 years old. She hadn't always thought of life in terms of years. She seemed to remember her father talking about the days before the white men came and took the land away. Her father had enjoyed hunting in the area that was now the park. After the tourists began to come by the hundreds on the train, he never went back in again. But they kept the cabin on the ridge overlooking the park. Even when she was very young, she remembered, her father would take her small hand in his big hand and walk along the ridge, looking down onto the string of beaver dams on the one side, and off into the park on the other side. Every now and then he would stop, lift her in his arms and gaze off toward the mountains. He would sigh a deep sigh occasionally, but he never said much.

Her father had been gone for many years now. Even one of her own children had passed on, but she didn't feel particularly old. She had seldom missed her evening walk along the ridge. She was sure that the walking had kept her young.

Lucy seldom looked up into the park. She had always enjoyed watching the beavers at their work among the ponds. Lucy had been so familiar with some of the beavers in the past that she had given them names. She even spoke to them at times. The beavers looked at her and were always aware when she was watching, but she never got the feeling that they cared to interact with her. At least they had grown to trust her. They seldom dove or even sounded an alarm when she came around, but they were much more skittish on the few occasions that she was joined in her walk by her daughter or her grandchildren. Lucy sometimes felt that the beavers were more a part of her life than even her children and grandchildren were.

It had almost killed her that evening twelve summers ago when she stood over the dam and saw the scattered limbs and mud, and saw what was left of the lodge standing nakedly above the silty bottom of the pond. When she had heard the dynamite in the morning she had been a bit upset, but she attributed it to road work in the park. It was several days before she learned that it was the Looks Back boy who had blown up all the dams in the string just to gather a few pelts worth less than thirty dollars each.

When she had gone to the boy's mother, the woman had told Lucy that she was sorry that the beavers had been so important to her, but it was really hard to raise boys these days. The son had told her that he needed to learn to hunt if he was going to be a provider and a warrior.

"No warrior ever used dynamite to catch a defenseless animal" retorted Lucy. She hadn't regretted making such a scene. She had never gotten used to the sight of the dried-up ponds. The trees and vegetation along the creek had clearly thinned out over the years. The birds had been gone since just after the dams went. Lucy hadn't even seen a brook trout in the creek in the last three years. They used to pop the surface like rain in the years before the dynamite.

Then one evening Lucy's heart jumped into her throat. There beneath her were two beavers and the creek was beginning to back up over the old pond bottom. Lucy had never dreamed that beavers would return to the drainage. She got so

Beaver, NPS Photo (Glacier Student Guide CD).

## Lucy Lone Walker
## An example of a contemporary story about caring for the Earth

excited she was afraid she'd have a stroke.

Then the thought struck her, "It won't be long and there will be another generation of young warriors nosing around here. What can I do. I couldn't bear to see it happen again." She hoped against hope that nobody would come along and see the new dam and the newly gnawed tree stumps.

The next evening and every evening after that Lucy carried a small paintbrush with her. Along the edges of the pond she rubbed the newly gnawed tree stumps with grass and painted them with mud. She scattered the chips among the deeper grass and heavy brush. The stumps actually looked like they had been there for years. She would just have to hope that no one would notice that the pond had ever drained.

One evening as Lucy bent over her work near the pond, a deep voiced chuckle sounded immediately behind her. "What are you doing Little Grandmother?"

"You nearly killed me young man. Can't you cough or something? Don't you know better than to sneak up on an old person like that?" The young man held a young girl in his arms. The child looked down when the old woman turned to her. The young man chuckled again, "I'm sorry Grandmother. I thought you heard us coming through the grass."

"But who are you? I've never seen you here before."

"But you have; a long time ago. I am called Charlie; Charlie Looks Back. Years ago I killed your beavers. I could never tell you how badly I felt. I brought this pair back from the Fish

Beaver lodge, NPS photo (Glacier NP Digital Image Library).

and Game in Missoula. They've got extra on Lolo Creek. I wanted my daughter to see you and them."

On the way back to the cabin that evening Lucy gazed off into the park and sighed, "I guess I'll probably be able to walk around up here for another 90 years now." [3]

[1] Montana Historical Society Education Office. *Land of Many Stories: The People & Histories of Glacier National Park*. Helena: Montana Historical Society Footlocker, 2010. PDF file.

[2] Glacier National Park. *At Home in This Place*. St. Mary: National Park Service Visitor Center Exhibits, 2010.

[3] Glacier National Park. *Work House: A Glacier National Park Science Education Program*. West Glacier: National Park Service, 1992, 1998. This story appears as it was written from the original version of Work House.

## Vocabulary

Federal - having or relating to a system of government in which several states form a unity but remain independent in internal affairs.
Generation - the average length of time between the birth of parents and the birth of their offspring.
Gnawed - worn down from being bitten or chewed on.
Manage - to coordinate functions of people to reach goals and objectives.
National Park - a federally designated area set aside and managed to preserve and protect the natural and cultural resources present there for current and future generations.
Pelt - the skin of an animal with the fur or hair still on it.
Preserve - to keep something for a long time.
Protect - to keep something safe from harm or injury.
Ridge - a long, narrow hilltop.
Sacred - very powerful in a spiritual sense.
Wilderness - an area where the Earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.

## Checking for Understanding

1. How is the concept of stewardship related to Glacier National Park?
2. List three things you could do to be a good steward for Glacier. How could the concept of stewardship have different meaning for different people?
3. Why do you think the park has rules against hunting or taking things out of the park?
4. Imagine yourself 12 years from now like Charlie. What do you want the Earth to look like in 12 years? Glacier National Park?
5. Do you support places being designated as national parks? Why or why not?
6. Can peoples' actions make a difference with whether wild and special places like Glacier endure? Why or why not?

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# Student Reading

## *Unit 2: Mountains and Mountain Building; Backbone of the World*

*Blackfeet:*
*Our traditions and values were given to us by the Creator and the spirit of the Other Beings in our world.*

*In many stories we have Old Man- Napi - who came from the south, making the mountains, the prairies, and the forests as he passed along, making the birds and animals also, arranging the world as we see it today.* [1]

## "Old Man and the Beginning of the World" a Blackfeet Story

In the long ago, Old Man (Napi) came traveling up from the south. He was feeling lonely and a little bit bored. He needed something to do to keep him busy. As he traveled he made the mountains, prairies, and forests with birds and animals to live among them. He traveled constantly northward making the landscape as we know it today.

He made the Milk River and some fishes to live in it. By this time he was a little tired so he laid down to take a nap. Where he rested on the hill above the river you can see an outline of his body formed with large rocks.

Still a bit groggy from his nap, he started to the north again but soon tripped over a little hill. He fell heavily to his knees and this upset him a bit. Old Man clawed up the ground and piled up soil to make two large buttes which are still known as The Knees today. A little absent minded, Old Man carried some of the soil with him as he continued north. When he realized that he had the soil in his hands, he stopped, knelt, and formed the Sweet Grass Hills. When he was finished he still had a little material left over. So, Old Man reached over to the west and plopped the extra material down next to the mountains. Created as an afterthought, that little pile today is known as Chief Mountain.

So Old Man continued on his journey to the north. When he created mountains and prairies he experimented with making animals that he thought might enjoy living in those areas. If they didn't like where he put them, he would switch them around. For instance, the bighorn sheep and the antelope decided to switch places. The antelope's cousin, the mountain goat, however, decided that he wanted to stay in the mountains. Old Man was agreeable. He just wanted all of his creations to be happy.

Old Man made grass on the prairies for grazers to feed on. In the foothills he planted trees and bushes with berries on them. He filled the soil with roots like camas, and bitterroot, wild carrots, and potatoes. He made many plants with different attributes that would be helpful to his creations. Everything that Old Man created had its own personality.

Still Old Man was lonely. He sat down beside a newly created river and began to play with a ball of mud. "Wouldn't it be nice," he said, "if there were creatures like me that I could talk to and play with." And the ball of mud in his hands began to take on a familiar shape.

Oral history is our culture. Our oral history holds the key to who we are. Our language is spiritual because it is taken from nature, and nature is spiritual. Our language doesn't need a verb to move the noun; it is in constant motion like the Earth. [1]
- Blackfeet

Oral History and Origin Stories[2]
An oral history is a historical account recorded in the memories, legends, stories, songs, art, and languages of people who did not create written histories. Oral histories are passed from one generation to the next and are as valid as written histories. Indigenous languages are the key to the survival of oral histories, as they can seldom be translated accurately into other languages. Kootenai oral histories tell of times when ancient animals such as woolly mammoths lived on this earth, indicating that the tribe's inhabitance in this region is indeed very long.

An origin story is a people's account of their own creation and beginning. For example, the origin story of the Kootenai tribe tells that they "woke up" (were created) at what we now call Tobacco Flats, along the Kootenai River. Origin stories are part of tribes' oral histories. They do not always concur (agree) with archaeological or academic theories about the origins of humankind, or human migrations. However, this does not mean that such stories are not true or do not have value and importance.

Chief Mountain, NPS photo.

*Kootenai:*
*We only share the details of the creation stories within the tribe.* Our creation stories help us understand that everything that is perceived by humans is actually a spirit with a purpose and a place in creation.*[1]

** This version of the creation story was approved for Work House.*[3]

## "A Visit to the Sky World" a Kootenai Story

Among the Old People (the animal people), Muskrat was considered to be a sneaky character. When his brother died, Muskrat wanted to marry his sister-in-law. She refused him. In his anger he shot her with an arrow that could not be identified by his people. When friends came to investigate the murder, Muskrat cleverly told them that the arrow had come from the sky.

The Earth People were convinced that the Sky People had killed the woman and they were determined to go to the sky to make war on the Sky People. The Earth People shot an arrow up into a cloud and when it stuck they shot a series of arrows, each into the notch of the arrow ahead of it, until they had formed a chain of arrows all the way down to the ground. Then the Earth People began to climb up into the sky.

Wolverine, who had wanted to go on the raid, was left behind. In his anger he jerked the chain of arrows down from the sky so that the Earth People would not be able to climb down. When the arrows fell to the ground, they formed a chain of mountains to the south of Kootenay Lake.

When he reached the sky, Muskrat ran ahead of the others and constructed a large lake with many tipis around it. After the rest of the Earth People arrived, they searched the village for their enemies but were only able to find Muskrat in hiding. They killed him and returned to make their way back to the ground only to find that the arrow chain was gone. They went in search of Thunderbird who lived in the clouds. They captured him and plucked his feathers. Then they glued the feathers to their bodies and flew down to the ground.

Woodpecker, his brothers and sister, and his cousin Flicker decided to stay up in the sky and explore a little. They walked until they reached the place where the Earth meets the sky. There they sat down on the shore of a large lake to rest. As they sat, a huge wave rolled up on the shore and poor Flicker was swallowed by Water Monster.

Woodpecker and his siblings ran from bay to bay and danced until the fish came to see what was happening. Woodpecker asked them to help locate Water Monster so that he could save his cousin Flicker. The fish were only too happy to help. When they finally located Water Monster, Woodpecker tried to kick the monster but his foot only struck a glancing blow. He and his brothers chased Water Monster all the way up Kootenay River and then back to the south along Lake Windermere. At Longwater Bay the monster dug an underwater cave and hid from the woodpeckers.

Just about then, the woodpeckers saw Old Grandfather Creator of the Kutenais crawling up from the south and naming all the places as he went. As he crawled he left scratch marks on the land and rivers flowed in the furrows left by his belly.

It is through our oral history that we know of our proper relationships with the rest of creation. Human beings were the last of all beings to be created and so we are the youngest brother in all creation. The traditional Kootenai would have this realization in mind as they walked through life and would carry themselves as one would when walking among elders. [1]
- Kootenai

"Quickly! Make a dam at the end of the lake to trap Water Monster," Woodpecker called to him.

Always obliging, Old Grandfather broke off a chunk of mountain, formed it with his knees, and created a portage between the Kootenay and Columbia rivers. Woodpecker was able to corner Water Monster until the rest of the Earth People came to help him slay the monster. They cut him open and out flew Flicker, a little thinner and weaker but still alive.

The animals cut the monster to pieces. They threw his ribs into the river where they formed cliffs. Then the animals dug hot springs around the area and cooked the blood and body parts until they were well done. The animals threw the parts around the land to become food for the New People.

## A Geological Story of Glacier National Park

*This is a story of changes over a long period of time described in "The Geology Along the Going-to-the-Sun-Road" by Omer B. Raup, Robert L. Earhart, James W. Whipple, and Paul E. Carrara.*[4]

Some of the main characters in this story are Plate Tectonics, Water, Wind, and Ice. Water, wind, and ice are the principle agents for the processes of excavation, transportation, and deposition of sediments. The break up of rocks into smaller particles is called "weathering." The the movement of the particles is "erosion".

The main plot of this story involves the force of gravity. With the assistance of the three main agents and some minor agents like humans and other animals, sedimentary material will work its way to the lowest point possible. One of the most efficient means of moving (eroding) sediments is water.

Between about 1,600 million and 800 million years ago, the rocks of Glacier National Park were formed from sediments eroded from a North American continent with a very different shape than it has today. The sediments were deposited into a shallow sea covering present day eastern Washington, the Idaho panhandle, western Montana, and parts of British Columbia and Alberta. The

View from Gunsight Pass of sedimentary layers and sill (dark layer close to top in furthest mountain) Danny On photo (Glacier NP Digital Image Library).

Prominent folding and layers, J.A. Tyers photo (Glacier NP Digital Image Library).

"The legacy of traditional ecological knowledge, the intellectual twin to science, had been handed down in the oral tradition for countless generations...But where did it come from?

...Like scientific information, traditional knowledge arises from careful, systematic observation of nature, from the results of innumerable lived experiments. Traditional knowledge is rooted in intimacy with a local landscape, where the land itself is the teacher." [5]

Pacific Ocean was located just west of Spokane, Washington. More than 18,000 feet of sediments were deposited resulting in a down warping of the ocean floor. Depending upon the source, amount, and content of the sediments, there were variations in the amount of down warping that took place. Ultimately an interesting marble or layer cake design was formed by various colored layers of sand, silt, and limey mud. The oldest layers of rock having been deposited first were on the bottom of the sequence.

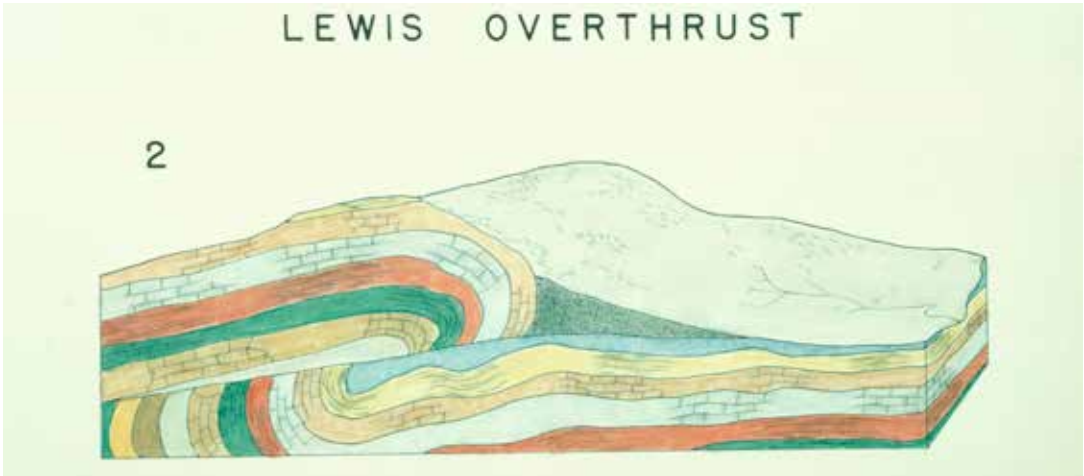
As compaction continued, deposited sediments became sandstone, siltstone, shale, limestone, and dolomite. Time, pressure, and heat associated with deep burial gradually metamorphosed these layers into other rock types. They became quartzite, siltite, shale, argillite, and recrystallized forms of limestone and dolomite. They were now much harder but looked much the same as they had before. Between about 1,000 million and 800 million years ago "pillow" lavas were extruded onto the shallow sea floor. Later magma was injected between some of the rock layers and up through faults in the formation's structure. These magma flows created sills and dikes. The igneous rocks are much darker than the surrounding limestone that has had organic matter literally "cooked" out of it. What you see today is like an Oreo cookie in reverse - the dark part in the middle with the cream filling on both sides.

Napi Student Artwork by Kent Monroe and Joe Conelly.

This igneous sill can be seen at some locations along the Going-to-the-Sun Road.

Sediment deposition continued after 800 million years ago but was not metamorphosed. These sedimentary rocks were not as hard as the older rocks. About 150 million years ago Plate Tectonics began to take an active role in the area. Two massive crustal plates began a collision that was to last until 60 million years ago. An ancestor of the present Pacific Plate moved to the east on a collision course with the North American Plate. The leading edge of both plates began to crumble and debris was pushed up at what was then the edge of the North American continent. Not much of the material could find its way down into the Earth's core. There wasn't much room. Material that did get forced down eventually heated up in the mantle, expanded, and erupted as volcanoes. In the process, numerous mountain chains developed. The battle of the plates continued until the western coast of North America extended several hundred miles to the west of where it was located before the collision began. As the Rocky Mountains began to rise, the shallow inland sea began to drain to the east. As soon as the tops of the mountains were exposed, water, wind and perhaps some ice began to go about their work of excavating, transporting, and depositing weathered sediments to lower elevations. The sediments that were deposited on top of the present-day rock layers of Glacier National Park were eroded away. High in Glacier National Park there remain only a few sedimentary rock formations younger than 800 million years old. Much of the eroded sediment was laid down to the immediate east of the mountains and formed a relatively soft, loose bed of materials. Fifty to sixty million years ago the pressure on the layers of uplifted rock became so great that a wedge of rock several miles thick faulted (fractured or broke apart) and slid more than 50 miles to the east over softer sediments. This action was a little bit like what would happen if you placed a thick layer of whipped cream on a slanted table with a layer cake on top of it. Eventually the cake would wind up on the floor. In the process, some of the cake layers would buckle into folds. This is what happened to the rock layers in the mountains. Billion year old rocks ended up on top of rocks that are less than 250 million years old.

Some 60 million years ago the great collision came to a virtual halt. Water and wind continued their relentless work. About two million years ago the Rocky Mountains were a bit higher than they are today,




(Glacier NP Digital Image Library).

but they were rounded and cut by broad stream valleys. At this point ice became involved in the act. The Earth's climate cooled considerably and the Ice Age began.

[1] Glacier National Park. *At Home in This Place*. St. Mary: National Park Service Visitor Center Exhibits, 2010.

[2] Montana Historical Society Education Office. *Land of Many Stories: The People & Histories of Glacier National Park*. Helena: Montana Historical Society Footlocker, 2010. PDF file.

3 Glacier National Park. Work House: A Glacier National Park Science Education Program. West Glacier: National Park Service, 1992, 1998. This story appears as it was written from the original version of Work House.

[4]Raup, Omer B. *Geology Along Going-to-the-Sun Road*, Glacier National Park, Montana. West Glacier, MT: Glacier National History Association, 1983.

[5]Kimmerer, Robin Wall. *Gathering Moss; A Natural and Cultural History of Mosses*. Corvallis: Oregon State University Press, 2003.

## Vocabulary

Argillite - very hard mudstone. The Precambrian mudstones in Glacier National Park are hard enough to be called argillites.
Belt Sea- an environment recorded by ancient rocks as a shallow sea that opened and closed over many millions of years. The origin of Belt series sedimentary rocks dates from about 1,600 to 800 million years ago.
Climate - the meteorological conditions, including temperature, precipitation, and wind, which characteristically prevail in a particular region.
Debris - broken pieces of rock.
Deposition - the process in which rock moved by water, wind, or ice is dropped in a new place.
Dike - a steeply-inclined sheet of igneous rock formed when molten magma is injected across the beds/layers in sedimentary rocks.
Dolomite - similar to limestone with considerable magnesium.
Downwarping - a broad depression in the Earth's surface.
Erosion - the movement of weathered rock by water, wind, or ice.
Extruded - to thrust or force out.
Faults - a break in rock which the opposite sides have been displaced.
Folding - a bend in rock from compression.
Geology - a science that studies rocks to learn about the history of the Earth and its life.
Ice age - a cold period marked by episodes of extensive glaciation alternating with episodes of relative warmth.
Igneous rock - formed by solidification of molten magma materials.
Intrusion - forcing of molten rock into pre-existing rock.
Lewis Overthrust Fault - action that folded older rock above younger rock in the northwest United States.
Limestone - sedimentary rock composed of calcite (mineral form of calcium carbonate).
Magma - molten lava beneath the Earth's surface.
Mantle - the interior of the Earth between the core and the crust.
Metamorphosed - rock transformed within the Earth's crust by heat and pressure.
Pillow lava - lava that has solidified as rounded masses, characteristic of eruption under water.

## Vocabulary Continued

Plate Tectonics - theory that Earth's outer shell is made of large slabs of rock (plates) that float on and travel independently over the mantle.
Quartzite - metamorphic rock which was originally pure quartz sandstone.
Rifting - to cause to split open or break.
Sand- fine pieces of rocks, consisting of small, loose grains, often of quartz.
Sandstone - sedimentary rock of sand or quartz grains cemented together.
Sedimentary Rock - has formed through the deposition and solidification of sediment, especially sediment transported by water (rivers, lakes, and oceans), ice ( glaciers ), and wind. Sedimentary rocks are often deposited in layers, and frequently contain fossils. Note : Limestone and shale are common sedimentary rocks.
Shale - a fine-grained sedimentary rock that forms from the compaction of silt and clay-size mineral particles that we commonly call "mud".
Sill - a layer of igneous rock injected as a molten magma between beds (layers) of sedimentary rock.
Siltstone - is a sedimentary rock which has a grain size in the silt range, finer than sandstone and coarser than claystones.
Weathering - the breaking down, dissolving, and wearing away of rock.

## Checking for Understanding

1. Are there any similarities between these three stories of the origin of the mountains? What differences are there in the stories?
2. How do these origin stories affect the Blackfeet, Kootenai, Salish and Pend d'Oreille peoples' relationship to Glacier National Park? Why would it be important to protect these stories?
3. Do you have a story that your family tells over and over again? How is it different or similar, to these stories?
4. Is there a place that means a lot to you and your family but doesn't have a lot of significance for someone else? Why?
5. Have you ever wondered how a land formation or something in the environment came to be?

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# Student Reading

## *Unit 3: Climate Changes; Glaciers and Glaciation*

There are a number of stories among the Salish, Pend d'Oreille, Kootenai, and Blackfeet people about the glacial dynamics of the area. "The Great Flood in the Flathead Country," and "The Origin of Flathead River," both give accounts of Glacial Flathead Lake. Two interesting stories, indicative of the accuracy of observations from traditional ecological knowledge, are the Salish story "Bluejay Brings the Chinook Wind" and the Blackfeet story, "Napi Punishes a Rock." [1]

**"Bluejay Brings the Chinook Wind" a Salish story - a** paraphrase of the story as it is recorded by Ella E. Clark in *Indian Legends of The Northern Rockies*.

In the very earliest times, Amotken, The Creative High Mystery, gave part of the North Crow Creek Canyon of the Mission Range to Thunderbird. Coyote was forbidden to enter the area and so Thunderbird was free to raise her young in peace. It was in the canyon that she gave birth to her three daughters: Bluejay, Crow, and Magpie.

Thunderbird was happy to let her friends from the Bitterroot Valley hunt and gather in the canyon. If bad weather was approaching from the East Pass, Thunderbird would make deep growling noises to warn her friends away. After many, many years of this friendly arrangement, a careless hunter neglected to put out his campfire and a huge fire destroyed all life in Thunderbird's beautiful canyon. With no trees and vegetation to hold the water, even the little creek dried up.

Thunderbird was understandably extremely upset about this careless act, and she was determined to punish the Salish people. She invited the cold Northeast Wind to drive the people back to the Bitterroot. The Northeast Wind set up permanent camp in the East Pass. He blew his frosty breath into the Salish country for many endless winters. The great lake of the Salish people froze to the bottom and all the animals were driven with the people to the Bitterroot Valley where they shivered with the cold. Even Thunderbird's daughters: Bluejay, Crow and Magpie followed the people to the south. Alas, the plants were unable to move on their own and they withered away and died.

Finally, after many, many winters the heart of Thunderbird was softened. She grew lonely; she missed her daughters, the other animals, and even the people. Thunderbird went to the Northeast Wind and asked him to leave. Thunderbird said, "The People have suffered enough now. Perhaps if you leave, my daughters will come back to visit me."

Reluctantly, the Northeast Wind left the East Pass and returned to his home. A wandering scout was startled by the sudden stillness to the north and rushed to tell the chief of the Salish who was huddled with his people around the Sleeping Child Hot Springs. "Northeast Wind no longer blows and from the north one can hear a gentle rumbling as if Thunderbird were weeping."

The chief was very pleased and told his people to prepare to move to the north again. He asked Coyote if he knew of a way to please Thunderbird so that she might hasten the warming of the old country. Coyote, was still upset that Amotken had forbidden him to enter North Crow Creek Canyon, and refused to help.

Bluejay had always loved the Salish people, and longing to see her

**"Bluejay Brings the Chinook Wind" a Salish story - a** paraphrase of the story as it is recorded by Ella E. Clark in *Indian Legends of The Northern Rockies*.

mother, offered to help. She flew to the west and asked her friend Chinook Wind to help her friends return to their old hunting grounds. Chinook Wind, always warm and kind, readily agreed to go and warm the valley. "Show me the way my little friend," he whispered and away they flew.

When they finally reached the little canyon beneath the Mission Range, Chinook Wind settled in for a long steady blow. His warm moist breath melted the thick ice and, as it receded, beautiful flowers and long grasses sprouted up along its margin. Soon there were trees once again in the Mission Valley. Thunderbird was pleased and asked Bluejay what she could give to her to show her gratitude. "In the future, Dear Mother," Bluejay said, "Do not get so angry. It is not right that the considerate people should suffer for the offenses of the careless."

Though the Northeast Wind returns to the East Pass each winter to remind us to live a thoughtful life, he always returns to his home when the Chinook Wind comes back to stay in the spring. For that we can thank Bluejay and a mother's love.

## "Napi Punishes a Rock" a Blackfeet Story

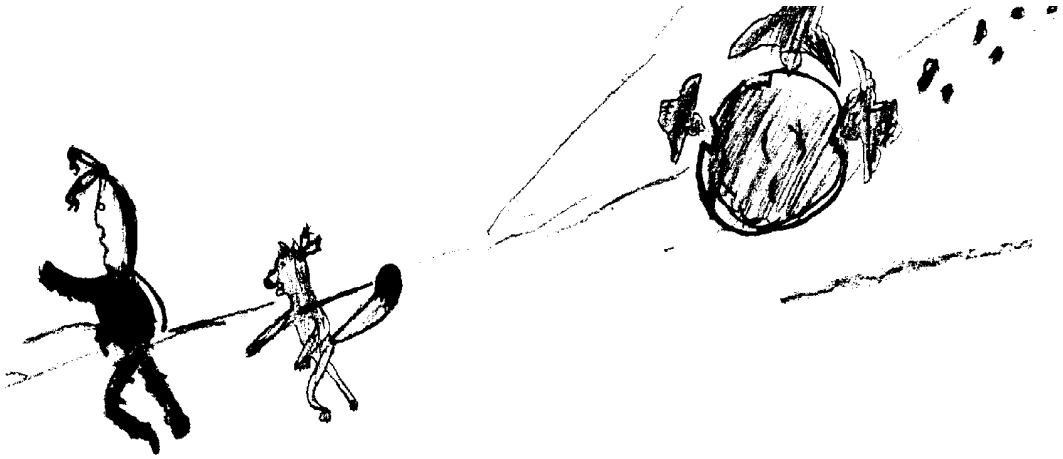
One beautiful Indian Summer day in the long ago times, Napi was walking with his friend Fox in the mountains above Cut Bank Creek. Although it was beyond the Moon of the Falling Leaves, the day was unusually warm. Napi, who always carried his buffalo robe, grew hot as they walked along. He and Fox stopped by a large black rock to rest and look at the scenery.

"Ah, Old Rock, you poor thing," said Napi, "You have to spend the long cold winter up here all by yourself with nothing to keep you warm. Here, take my robe." With that, Napi gently placed his robe over the rock and the two friends continued on their way.

Soon, however, as often happens in Indian Summer, there was a sudden change in the weather. Steel gray clouds began to roll in from the northwest. The wind howled and stinging flakes began to pelt the two hikers.

"Fox, old friend," asked Napi, "would you mind running back to get my robe?"

The kind Fox ran back, but soon returned with the message that the rock was not willing to part with the robe and that he was quite angry that Napi would have the nerve to take back a gift. Just then they felt the earth shake and heard a loud rumble. Napi looked over his shoulder and saw the boulder rolling down upon them along the path.



Napi Punishes a Rock
Student Artwork by
Shayne Hall.

"Oh, oh," yelled Fox. "We had better hightail it out of here. I think he is really angry!"

The two fugitives ran out of the mountains and out onto the prairie, but they could not outdistance the rock. Just as they felt they could run no farther, Napi spotted his friends the Nighthawks. "Quickly," he shouted, "stop that rock before it squashes us."

The fast-flying Nighthawks dove at the rock again and again. Each time they pecked at it, another large piece of rock broke off. Soon there was nothing left but a widely scattered trail of smaller rocks. The two friends collapsed upon the ground and thanked the Nighthawks between gasps. "In commemoration of this great deed you will always wear bright white slashes of honor across your wings."

It is because of this memorable chase that you still see these strange rocks from the mountains scattered far out onto the plains.

## "The Work of Ice" a Glacier Story

Many people who visit Glacier National Park for the first time expect to see large glaciers with snouts that come right up to the edge of the road. Instead, they catch long-distance glimpses of small glaciers high in the mountains. Visitors who hike have an opportunity to examine the remnants of glaciers that were much larger in times past.

Since the Ice Age began approximately two million years ago, at least four major continental ice sheets have advanced into this area and then receded. As the continental glaciers approached from the north and east, glaciers began to grow and advance in the mountains. The ice got so deep that it nearly covered the tops of the mountains and on several occasions the resulting valley glaciers joined with continental ice sheets on the east side of what is now Glacier National Park.

Glacier National Park was named for the glacially carved features that give character to the mountain landscape. As of the turn of the millennium, fewer than twenty-five small glaciers still exist in the park. By studying and comparing the small remaining park glaciers with large glaciers that are still dynamic agents in other parts of the world, scientists are able to understand what occurred in this area so many ages ago. On going research in Glacier National Park and models predict that these remaining glaciers will be gone within the next decade. Ecologists and climate scientists are grappling with how that may affect the plant and animal communities in the park.

What is the work of ice? What is a glacier? The term "glacier" is derived from the French word "glace", meaning ice. Some two million years ago the climate in this area began to grow cooler. More snow accumulated in the mountain valleys than melted during the warmer months. After a time the accumulated snow began to contribute a further chilling effect to

the weather. As the snow got deeper, it compressed. The underlying snow began to metamorphose or recrystallize into a dense form of ice called firn. By the time the firn reached a depth of about 150 feet it was solid ice.

Because the snow accumulation was heaviest at the higher ends of the mountain valleys, most of the growth originated there. Pulled toward a lower elevation by gravity, the newly formed glaciers began to move slowly down the valleys.

As the front of the glaciers moved to lower elevations, snow continued to accumulate at the head of the valley. Soon the small glaciers became giant valley glaciers. Eventually the accumulation of snow and ice became so extensive that at times only the highest peaks in the park remained above the glaciers.

The base of a glacier is under so much pressure that it behaves like soft plastic, oozing around and sliding over the underlying bedrock and soil. Glacial ice fills every crack and moves house-sized boulders with ease. Once a rock or boulder has been enveloped in the base of a glacier, it becomes a tool for carving and abrading (rubbing away) the surface over which it moves. The net result is a relatively straight and flat U-shaped valley where an uneven V-shaped, stream-carved valley previously existed.

Not only does a glacier carve the valley floor, it also plucks material from the surrounding valley walls. While the base of the glacier excavates (digs) deep into the bedrock, and the flanks (sides) of the glacier pluck and gouge the surrounding slopes, the tail of the glacier continues to pluck away at the headwall. Seasonal temperature fluctuations cause the glacier to melt against the headwall leaving a narrow gap between rock and ice in summer. The gap fills with melt-water that turns to ice each winter, eroding the rock by expanding in tiny cracks. This bergschrund, or gap area, undercuts the headwall to the point where the top of the headwall actually overhangs its base. Eventually, the overhang collapses onto the glacier and the process begins again.

Many glaciers move as slowly as a few centimeters a day, while a few large Alaskan glaciers can travel as

U-shaped valley, Ken West photo (Glacier NP Digital Image Library).

fast as 150 feet in a day. The glacier does not move as a solid unit. Because of resistance at the base and along the valley walls, the flow of ice near the surface and center of a glacier is often faster than at the bottom and sides. The cracks that result when upper layers of the ice move faster than lower layers are called crevasses. They can be hundreds of feet deep and many feet wide.

Eventually, the snout or end of a glacier reaches a point where lower elevation or warming temperatures create an equilibrium between annual snowfall and snowmelt. The glacier can advance no further. In the event of a climatic warming trend, the annual snowmelt may exceed the amount that falls, and a glacier begins to recede (melt back). Most of Glacier National Park's glaciers have shrunk dramatically in the last century.

A glacier carries a tremendous load of eroded material in a constant conveyor process toward the toe (front) and edges of the glacier. Ice at the toe melts and runs off as glacial outwash. New ice is constantly being replaced near the head of the glacier. Rocks break up much more slowly than ice, eventually ending up at the toe or sides where they are deposited as glacial till. Till consists of a jumble of rocks, gravel, dirt or other debris that may have been picked up by the glacier. Piles of till along the margins of a glacier are called moraines.

If the moraine occurs at the point of farthest advance of a glacier, it is called a terminal moraine. Sometimes a glacier will retreat up a valley and stabilize temporarily at various stages of the recession. In such a case it may leave a series of what appear to be terminal moraines, but are referred to as

Roped up hikers at bergschrund in foreground, NPS photo (Glacier NP Digital Image Library).

recessional moraines. If a glacier retreats steadily, it leaves a variety of till and outwash formations along the path of recession back up the valley. While a glacier is moving, till tends to work its way to the sides of the valley and be deposited along the glacier's flanks. During the lifetime of a glacier, the amount of till that builds up along its sides can be impressive. The resulting long, fertile hills, called lateral moraines, are conspicuous along major valley edges in Glacier National Park. The lateral moraines are most often recognized by dense conifer forests that cover them.

All glaciers have melt water running from their snouts during warmer seasons. The melt water carries a load of sediment for deposit along an outwash plain. Depending upon the volume and speed of the outwash

stream, sediments are sorted and deposited along the floor of the plain. Respective weights of the various particles determine where they will be deposited, near the snout of the glacier or further downstream. Outwash streams are frequently forced to change their courses because they fill with these sediments. The net result is a network of braided streambeds on the outwash plain.

The lightest, smallest sedimentary particles may be carried a long way until the stream has slowed considerably. This pulverized rock is appropriately called glacial flour. Glacial flour is particularly evident in the remnant tarns or mountain lakes that lie in the abandoned cirques near the headwalls of glaciers. The flour is actually the grist left from the grinding force of the glacier. Remnant icefields beneath the headwalls in Glacier National Park continue to color the lakes with their flour. In the park every lake has a slightly different color, depending upon the makeup and mixture of rocks. Some lakes have a white tint that actually suggests flour, but more often they are various shades of blue and green.

A number of curious formations left by retreating mountain glaciers are found on both sides of Glacier National Park. Many of the lakes among the foothills on the Blackfeet Reservation and in the Flathead Valley are called kettle lakes. They were formed when a melting mass of glacial ice remained in a depression after the main body of the glacier had retreated further into the mountains. When the mass finally melted, a depression remained. In time, it filled with water. Teardrop-shaped drumlins, or hills, were left where the bedrock resisted the gouging of an advancing glacier. Softer, surrounding rock was worn away and these elevated nuclei collected sediments that built up around them as the glacier retreated. Eskers, elongated hills, were formed by sediments deposited by streams flowing in tunnels beneath the ice. Kames, another form of depositional hill, were formed when openings developed in stagnating (not moving) ice. Glacial erratics have long been a source of fascination. Erratics, often found in open country, many miles from any possible source, are either unusually large boulders found among smaller till or large rocks that were ice-rafted and deposited on the floor of glacial outwash lakes.

The most dramatic and obvious glacially carved features are found along the courses of U-shaped troughs left by the now-departed valley glaciers. The high sharp peaks are called horns. Serrated narrow ridges left between the headwalls of two adjacent glaciers are called aretes. Along the sides of the main glacial troughs, hanging valleys are often found where smaller tributary glaciers once abutted the main glacier. Beneath the headwalls of each of these tributary glaciers, one often finds a depression called a cirque which may hold a tarn or cirque lake. Along the course of the main glacial trough there are a series of truncated spurs, cliffs bulldozed into the sides of gradual mountain slopes.

[1] Glacier National Park. Work House: A Glacier National Park Science Education Program. West Glacier: National Park Service, 1992, 1998. All of the stories here and the background information comes from the original version of ***Work House*** with some updates for the Glacier story section.

## Vocabulary

Arete - a knife-edged ridge gouged by glaciers on both sides.
Cirque - a bowl-shaped hollow scooped out of the side of a mountain at the head of a glacier.
Continental ice sheets - big continental glaciers are called ice sheets. Greenland and Antarctica are almost entirely covered with ice sheets.
Continental glaciers - continuous masses of ice that are much larger than alpine glaciers.
Firn line - the lower limit of the area on a glacier in which the previous winters snowfall survives the next summer.
Glacial erratics - a piece of rock that differs from the size and type of rock native to the area in which it rests having been carried there by a glacier.
Glacier headwall - the steep rock rising above the floor of a glacial cirque.
Horn peak - a mountain that has been carved away by glaciers (usually on 3 sides) to a pointed shape. Many of the prominent peaks in Glacier are horns.
Kame - a small hill of water-sorted and layered glacial debris in a moraine of unsorted till. Most kames consist of debris that washed into a hole or crack in the ice.
Tarns - an alpine lake occupying a basin hollowed out of solid bedrock by glacial erosion. A cirque lake.
Truncated spurs - spurs that projecting into the original river valley are cut short (truncated), their lower ends being destroyed by the moving ice.

## Checking for Understanding

1. How can a glacier be evidence of climate change?
2. What observations of the landscape were included in the Salish and Blackfeet stories?
3. How do these oral histories provide evidence of climate change?
4. How can the glaciers and ice sheets we have on the Earth today show us what to look for in order to find places where glaciers or ice sheets may have been before?
5. What lesson(s) can we learn from all three of these stories?

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Glacier National Park

# Student Reading

## *Unit 4: Native Plants; Our Medicines, Our Food*

## How Did Early Peoples Use Native Plants?

Jeff Hart, who spent two years talking with elders from tribes across Montana and then wrote, "Montana Native Plants & Early Peoples," says in his introduction,

> Although we think of wild game as the source of the Indians' primary sustenance in Montana, we often overlook the significant role played by plants. From the plant kingdom Indians gathered berries, seeds, and nuts, dug roots, bulbs, and rhizomes; brewed various teas; cut young green shoots to eat raw; peeled trees for their sweet inner barks, and found spices for their foods. From plants they got most of their medicines to heal the sick and injured. Some plants possessed magical properties to ward off malefic spirits or summon beneficent one. In some they found scents which perfumed their lodges and sweathouses. Others they smoked in their pipes, made into shampoos and tonics for their hair, or used as insecticides for unwanted bugs. They discovered remedies for ailing horses, dyestuffs, and materials used in the manufacture of such items as bows, arrow shafts, and tipi poles." [2]

## Plants As Cultural Resources

Among the cultural resources protected in Glacier National Park are certain native plants like -bitterroot, blue camas, western red cedar- as well as culturally scarred trees (trees that have been scarred by the American Indian practice of peeling back the bark to expose the cambium layer). What is a cultural resource and what makes some plants or trees more in need of protection than others?

Cultural resources are grouped into five main categories: archeological resources, cultural landscapes, historic structures, museum and archive collections, and ethnographic resources (significant to a specific culture). In Glacier National Park ethnographic resources include sites associated with creation stories, prayer and fasting sites, and certain plants -like the ones mentioned earlier- valued by the Blackfeet, Salish, Pend d'Oreille, Kootenai, and other Tribes.

The physical parts of cultural resources are, with few exceptions, nonrenewable. A primary concern of cultural resource management is to minimize the loss or degradation of culturally significant material.

Because the park contains these cultural resources, consultation with local Tribes is necessary when work is proposed that may affect those resources. Management of ethnographic cultural resources acknowledges that culturally diverse groups have their own ways of viewing the world and a right to maintain their traditions.

## Plant Gifts

In "Gathering Moss," Robin Wall Kimmerer, Associate Professor at the State University of New York College, writes about combining her perspectives as a university professor and an American Indian when looking at plants,

> The knowledge I have of plants has come from many sources, from the plants themselves, from my training as a scientist, and from an intuitive affinity for the traditional knowledge of my Potawatomi heritage. Long before I went to university to learn their scientific names, I regarded plants as my teachers...(vii)

Cultural Resources

Think about the types of clothes you wear, the style of house you live in, or the model of car your family drives. Will they be the same fifty years from now? What does it tell people about your culture- your lifestyle, family background and available materials or resources?

*There is more than what you see here.*[1]
-Tony Incashola,
Pend d'Oreille

In Indigenous ways of knowing, it is understood that each living being has a particular role to play. Every being is endowed with certain gifts, its own intelligence, its own spirit, its own story. Our stories tell us that the Creator gave these to us, as original instructions. The foundation of education is to discover that gift within us and to learn to use it well.

These gifts are also responsibilities, a way of caring for each other. Wood Thrush received the gift of song; it's his responsibility to say the evening prayer. Maple received the gift of sweet sap and the coupled responsibility to share that gift in feeding the people at a hungry time of year. This is the web of reciprocity that the elders speak of, that which connects us all. I find no discord between this story of creation and my scientific training. This reciprocity is what I see all the time, in studies of ecological communities...

If each plant has a particular role and is interconnected with the lives of humans, how do we come to know what that role is? How do we use the plant in accordance with its gifts? The legacy of traditional ecological knowledge, the intellectual twin to science has been handed down in the oral tradition for countless generations....(100)

Our ancient teachers tell us that the role of human beings is respect and stewardship. Our responsibility is to care for the plants and all the land in a way that honors life. We are taught that using a plant shows respect for its nature, and we use it in a way that allows it to continue bringing its gifts (110) [3]

## "Nawak'osis, the Sacred Herb" a Blackfeet Story

In the long ago there were four brothers with great spiritual power. They were chosen by the High Ones to bring tobacco, its pipes, prayers, songs, dances, and ceremonials to the people. When these things had been revealed to them by the spirits and after the brothers had found the sacred herb, made their pipes of bone, learned the proper songs, prayers, and dances; they sat down to smoke. The four medicine men prayed together, inhaled, exhaled, and watched the smoke rise up to the sky. The fragrant smell filled the lodge and surrounded them with calm and peace.

The oldest brother, feeling powerful, wise and clear-headed, said to his brothers: "This thing we will call nawak'osis. It is good. It is strong medicine. We will keep it to ourselves and we will have even greater power." So the four of them formed a Tobacco Society. They crept off into the foothills to plant the sacred plant in a secret garden and they kept the sacred prayers, songs, and rituals to themselves.

The spirits had meant for the gift of tobacco to be shared with the people. Tobacco would encourage peace, calmness, control, unity, and prayerful life. Without it there was anger, war, discord, and impiety among the people.

In the same village there lived a just man named Bull by-Himself. He saw that the four medicine men had received a gift from the spirits and that they had refused to share. To his wife, Bull-by-Himself said, "This discord is a result of selfishness on the part of these men. We must find this plant called nawak'osis and we must learn the sacred ways so that we can share them with the people."

The man and his wife took themselves to a sacred lake where they put up their lodge and began the search for the sacred herb. Everyday Bull-by-Himself went in search of nawak'osis and everyday he returned with plenty of game but no sacred herb.

One day, as his wife knelt by the tipi door scraping a hide, she heard beautiful music coming from the shore of the lake. She looked high and low for the source of the beautiful voices, but could find nothing until she came to the site of a beaver lodge. When her husband returned she took him to the lodge to hear the music but he could hear nothing.

In her frustration, the woman took her knife and cut into the side of the lodge. The couple peered in to see a family of beavers singing and performing a graceful dance. "My brothers," she called, do not keep this wonderful medicine to yourselves. Teach us to sing and to dance."

"Close the hole. You are letting the cold in." They replied. "We will come to visit you in your lodge."

That very evening four beavers came to visit the worthy couple. Immediately upon entering the lodge they transformed themselves into four handsome young men. The oldest turned to Bull-by-Himself and asked, "Why have you come to this place?"

"I have come in search of the sacred herb nawak'osis and its ceremonies." "You have come to the right place worthy brother. Nawak'osis is water medicine and we are water people. We will give you the sacred herb and instruct you in the ways of its use."

For many days the beaver people instructed the young couple in the

## "Nawak'osis, the Sacred Herb" a Blackfeet Story

Kinnikinnick, Arctostaphylos uvi-ursi, the dried leaves were used in tobacco mixtures, NPS photo (Glacier NP Digital Image Library).

rituals that surrounded tobacco. The husband hunted and his wife prepared the skins of all the water animals. "You must do this," said the head beaver, "because these animals represent the life force of water. The Sun begets life, and water is the source of its growth."

Every evening Bull-by-Himself and his wife practiced the ritual songs, prayers, and dances with the beavers. Together they prepared the Beaver Medicine bundle. On the final night of their instruction the beavers presented them with a plant that looked like a common weed. The stalk was topped with a bundle of tiny round seeds. The beavers placed the seeds into the medicine bundle that the woman had prepared.

"Now it is time to plant the seed," said the beavers. "Do not touch these seeds until you are ready to place them in the ground. Locate your garden in a balance of shade and sun. Mix the soil in equal portions of brown and black and till it often. Then say the prayers that we have taught you."

"When all this is in readiness, Bull-by-Himself, take the antler of a deer and make holes in the earth. You, woman, must use a buffalo-horn spoon to drop a single seed in each hole. As you plant, sing the songs we have taught you; dance the dance you have learned as you tamp the soil over the seeds. Then watch patiently and nawak'osis will come. Now you know all and it is time for us to go." With that the four young men turned and as they trailed through the door of the lodge they resumed their beaver shapes.

Bull-by-Himself and his worthy wife cultivated their garden in a prayerful manner as they had been instructed. The four selfish medicine-men saw them at their work and wondered what they were doing. They listened to their songs and found them familiar. But they laughed to themselves, secure in the knowledge that only they possessed the sacred plant, knew the appropriate rituals and had the power that came from the spirits.

Just before the time arrived to harvest the sacred herb a terrible storm came in the night. Early the following morning the four brothers slipped away to their secret garden only to find that their crop had been devastated by hail. Not so much as a seed could be salvaged from the washed out remnants of their garden.

## "Nawak'osis, the Sacred Herb" a Blackfeet Story

Dejected, the four selfish men returned to the village in time to see Bull-by-Himself and his wife presenting their gift to the village people. In disbelief they looked at the plants and were forced to acknowledge that this was indeed the sacred herb they had tried to keep to themselves.

This is the way in which Bull-by-Himself and his wife brought the gift of the beaver people to the tribes. Their ancestors have always shared the gift of nawak'osis and followed its rituals in a sacred manner.

## "The Origin of Bitterroot" a Salish story

Long ago, when the Salish people still lived to the south in the area that is now called the Bitterroot Valley, there was a time of severe famine. In those sad days there lived a righteous old woman, the wife of a medicine man. The old woman grieved for her children who were slowly starving. With no meat and no fish to eat, her sons were doing their best to get by on some old dried up shoots of balsamroot. Even those were nearly gone.

"My sons have nothing to eat and will soon be dead," she sobbed. So she took herself down to the banks of the creek we call Little Bitterroot and laid herself down to mourn for her children. With her face to the ground and her old gray hair spread about her head she wept bitter tears as she wailed a song of death.

As the Sun rose up over the mountains and peered down into the valley, he was greatly sorrowed to hear the old woman's death chant. The Sun called forth the guardian spirit of the woman and said, "Your daughter is in need. Go to her; give her comfort and bring forth food and beauty from that which is dead."

Assuming the form of a beautiful red bird, the guardian spirit flew down to the old woman and gently spoke to her. "Your bitter tears have soaked the earth beneath you. Even now they are mingling with the dead vegetation below to form the roots of a new plant. Its fleshy leaves will lay upon the ground and a beautiful flower will rise up to the Sun. Its blossom will share the silver-white color of your hair and the rosy hue of my wings. Your children will dig the roots of our gift plant. Though they will find its taste as bitter as your tears have been, they will know that it is good food and they will grow to love it.

Each year, in the moon of deep water, they will see the return of the blossoms and say, 'See, there is the silver hair of our mother upon the ground and there are the rosy wings of the spirit bird. The love and bitter tears of our mother have provided us with food for all generations.' "

## The Native Plants of Glacier National Park

Glacier National Park's unique location, climate, and terrain provide an unmatched laboratory and gathering point for plant species and communities. Over 1400 plant species occur in the Park. Of those, forty-one species are rare in Montana and twenty-eight species are not found anywhere else in the state.

Glacier's native flora are one measure of the high level of biodiversity present in this protected area. Due to unique interactions of elevation, moisture and prevailing temperatures, Glacier National Park contains the eastern most extension of a Pacific Coast forest community characterized by western red cedar and western hemlock. The North Fork prairies harbor an island of vegetation including Palouse grasses characteristic of grasslands to the south and west in Idaho, Oregon and Washington. Plant communities characterized by aspen groves and Canadian and Great Plains prairie grasses reach no further west than the northeastern margins of Waterton Lakes and Glacier National Parks. Some of Glacier's alpine plant species occur in the central Rockies and range little further north than here, while some boreal tundra species reach their southern limits in the alpine environment.

A drive across the Going-to-the-Sun Road passes through life zones that can only be duplicated by travelling 1800 miles north at a constant elevation. Naturally within this huge continuum of habitat there is also a great diversification of life forms. Although there are no two places in the Park which provide precisely the same habitat and resultant biotic communities, there are some general community types that can be examined at various elevations and locations throughout the Park.

### Forests Born of Fire

An important agent in forest succession is fire. The mosaic pattern of plant communities characteristic of Glacier National Park and the surrounding ecosystem results from a succession of fire-related events that impact most northern Rocky Mountain forests over a cycle of 100-300 years. Some fires have less impact on a plant community than others, and the natural fire cycles have been altered and interrupted by human intervention.

Until recently, all fire was viewed as having predominantly negative effects upon the environment, but plant ecologists now realize that fire is an essential agent to healthy diversified plant communities. Park and forest managers are now studying and implementing prescribed burn and controlled burn policies in order to promote more natural patterns of plant succession and diversification.

Seeds of some plants survive in the soil for many years but germinate and bloom only after a major fire prepares the environment. Some species spread seed into an area year after year without successful germination. A crown fire can clear away the forest canopy, increasing the amount of sunlight able to reach the forest floor. Fire can also burn through the carpet of leaves and needles on the forest floor, exposing the soil which allows some plants to grow where they could not previously survive. In fact, were it not for fire, certain seral species (plants which have an intermediate role in forest community succession) might completely disappear from an area. Species such as wild geranium, wild hollyhock, dragonhead, and snowbrush appear in a given area for a short period every 100-300 years if the fire cycle follows a natural course.

## The Native Plants of Glacier National Park Continued

Before the European emigration to North America, American Indians lived within the natural limits of their environment and managed it to suit their needs. They often set prairie and forest fires to clear pathways, herd game, and stimulate new growth.

### Plants Succession

While we are aware of the ability of animals to move and adapt to changes in their environment, there is a tendency to think of plants as stationary organisms with little ability to adapt or move. In fact plants have evolved many devices and techniques for protection, proliferation, and transportation. Looking at a record of botanical succession over time, it is clear that plants do change locations based on climatic factors. A time lapse film set for a period of 2,000 years might show forests moving up and down the slopes of Logan Pass several times as climactic changes occurred. In fact evidence indicates that the dwarfed groves of trees at Logan Pass did extend higher up the mountains in the recent past. Currently they may be in the process of moving up the mountain side again.

The ecological importance of the Glacier National Park area for the future cannot be overemphasized. The surrounding areas and most of the country in general are under intensive management for the production of food, lumber, and mineral resources. Protected areas like national parks must continue to provide a refuge for plant and animal species and communities that can no longer flourish outside the area. In a time when the last remnants of native wilderness are quickly

Researchers documenting culturally scarred tree, NPS photo.

## The Native Plants of Glacier National Park Continued

being absorbed by civilization, it is extremely important to preserve, protect, and restore Glacier National Park and as much of the surrounding area as possible. The biological diversity of the Glacier ecosystem must be maintained for future generations.[4]

[1] Glacier National Park. *At Home in This Place*. St. Mary: National Park Service Visitor Center Exhibits, 2010.

[2]Hart, Jeff. *Montana Native Plants & Early Peoples*. Helena: Montana Historical Society Press, 1976.

[4]Kimmerer, Robin Wall. *Gathering Moss; A Natural and Cultural History of Mosses*. Corvallis: Oregon State University Press, 2003.

## Vocabulary

Alpine - type of habitat above tree line with short summers, long winter.
Biodiversity - the variety of different species in an area.
Biotic community- all of the living things that occupy a habitat.
Boreal - relating to the forest areas of the Northern Temperate Zone.
Culturally scarred trees- trees that have been scarred by the American Indian practice of peeling back the bark to expose the cambium layer.
Ceremonial - an established system of rites or formal actions connected with an occasion.
Culture - patterns, traits, and products of a particular period, class, community, or population.
Cultural resource - physical evidence or place of past human activity: or natural feature of significance to a group of people traditionally associated with it.
Degradation - a decline to a lower condition, quality or value.
Ecological - concerned with the relation of living organisms to one another and to their physical surroundings.
Elevation - height above a given level, especially sea level, altitude.
Endowed - provided with a quality, ability, or asset.
Ethnography - the scientific description of the customs of individual peoples and cultures.
Ethnobotany - the study of a culture's use of plants.

## Vocabulary Continued

Flora - the plants of a particular region, habitat, or geological period.
Germinate- to begin to grow or develop.
Herb - any seed-bearing plant that does not have a woody stem and dies down to the ground after flowering.
Heritage - features belonging to the culture of a particular society, such as traditions, languages.
Indigenous - used to describe a plant, animal or person that is native or original to an area.
Mosaic - composed of a combination of diverse elements.
Non-renewable - cannot be replaced once used up or gone.
Perspective - a particular attitude toward or way of regarding something; a point of view.
Potowatomi - an Indian people of the lower peninsula of Michigan and adjoining states.
Prescribed burn - the process of planning and applying fire to a predetermined area, under specific environmental conditions, to achieve a desired outcome.
Proliferation - a rapid increase in numbers.
Reciprocity - mutual exchange where each enjoys an equal benefit.
Refuge - a place providing protection or shelter.
Resource - something that is used within an environment and upon which people have placed or assigned value.
Righteous - in accordance with accepted standards of morality, justice, or uprightness; virtuous.
Ritual - a religious or solemn ceremony consisting of a series of actions performed according to a prescribed order.
Sacred - related to religion or something treated with great respect.
Stewardship- management or taking care of something.
Succession (forest, plant) - process of following in order or sequence.
Terrain - the specific physical features of an area of land
Value - the importance, worth, or usefulness of something.

## Checking for Understanding

1. Do you think people will follow the request that Coyote stories only be told in winter- why or why not?
2. How might this information be useful to all people today?
3. How is traditional tobacco use different from smoking cigarettes?
4. How similar/different do you think are the views about plants that Robin Wall Kimmerer describes from her Potowatami heritage with the views about plants from Montana Tribes ?
5. How does fire influence plant succession and biological diversity?

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# Student Reading

## *Unit 5: Animals and Habitats*

"Animals were the original managers of this land, not people." [1]
-Rusty Tatsey, Blackfeet

Salish and Pend d'Oreille
In many of the sqʷlllum̓t - the ancient stories of the creation and transformation of the world and its creatures - Salish and Pend d'Oreille elders tell of Snc̓l̓é, Coyote, who traveled across the land, killing the naɬisqélixʷtn - the people-eaters or monsters. Coyote prepared the world for the human beings who were yet to come. He showed that by living the right way - with the land and with each other - the people would always have sustenance and good fortune. These sacred stories of Coyote and the other animal people, and of the world's creation, are told only during winter.[1]

## The Origin of the Beaver Medicine

(Blackfeet Story abridged version based on several variations[2])

In the long ago there were two orphaned brothers named Akaiyan and Nopatsis. They lived with the evil-hearted wife of Nopatsis who didn't like having Akaiyan around the lodge. She plotted to make Nopatsis believe that she had been assaulted by Akaiyan so that Nopatsis would do away with him.
Nopatsis convinced his brother to build a raft and float out to an island where many birds nested so that they could gather feathers for arrows. Akaiyan was a trusting soul and was always pleased to do things with his brother. When he returned to the shore with a load of feathers, he was shocked to see his brother far out in the lake on the raft. He yelled to Nopatsis to come back for him. Nopatsis replied that Akaiyan deserved to be abandoned because he had insulted his brother and abused his sister-in-law. He promised to come back for Akaiyan's bones in the spring.

Akaiyan wept in despair, but he prayed to the animals and the underwater spirits for help. He also prayed to the Sun, Moon, and Stars; and after a time he felt a little better. He went to work preparing himself for winter. He made a lodge of sticks, clothing from feathers, and killed many of the island birds for food. He was fairly well prepared, but still he was hurt and lonely.

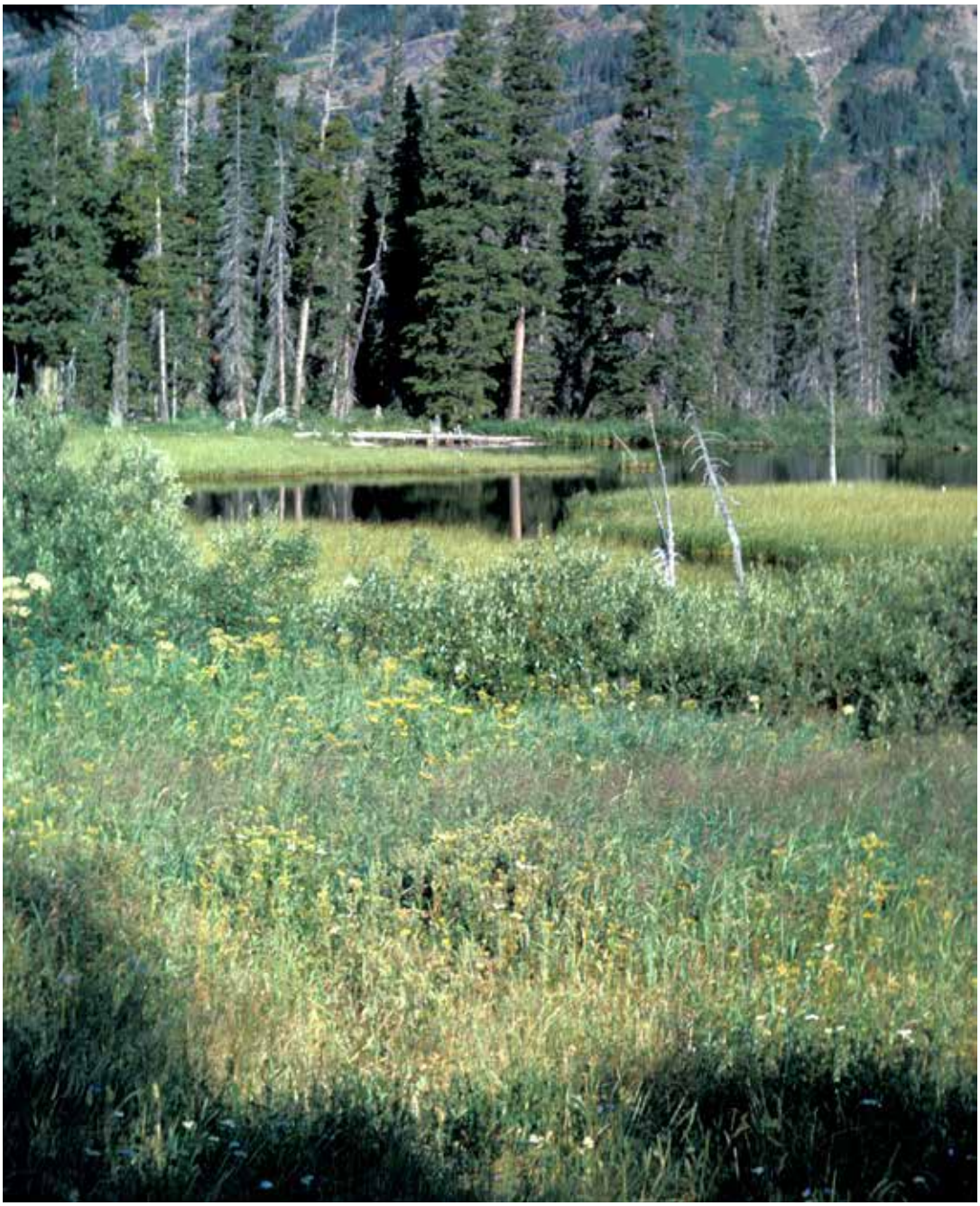
One day he came across a beaver lodge and sat watching it and feeling sorry for himself. Before long, a little beaver came out and asked Akaiyan to come into the lodge with him. Inside Akaiyan found a huge white beaver whom he knew to be the chief of all beavers. The Chief Beaver listened to Akaiyan's tale of woe and invited him to winter with his family. He told Akaiyan that the beavers would give him great power and knowledge with which he would become a leader of his people.

So Akaiyan spent the winter with the beavers. They cuddled him to keep him warm and treated him like one of the family. They taught him to live according to their simple and harmonious relationship with nature. They taught him the uses of roots and herbs for medicine. They taught him where to find sacred paints and how to use them in healing ceremonials and as protection for their bodies and dwellings. They gave him the first tobacco seeds to take to his people and taught him the ceremonials of smoking. They taught him to measure time, what to call the various Moons, and how to keep a calendar. Most important, they taught him the proper dances, songs, and procedures to do ceremonials so that he could heal his people when they became ill. Finally the Chief Beaver instructed Akaiyan to make

the sacred Beaver Medicine Bundle to be used in the ceremonials when he returned to his people.

When seven moons had passed and the ice began to break-up, the Beaver Chief offered his adopted son a choice of anything in the lodge to take with him. Akaiyan, who had grown very fond of the youngest beaver, who had invited him into the lodge, asked if he could take the youngster with him. The Beaver Chief was reluctant to part with his youngest child, but Akaiyan repeated his request four times. The Beaver Chief taught him that four times is the sacred number of repetitions for any ceremonial. The Beaver Chief could not refuse the request. Soon after this, the Beaver Chief spotted Nopatsis searching the shores for Akaiyan's bones and hurried to the lodge to tell Akaiyan. Akaiyan put the young beaver under his arm and dashed to the raft. When Nopatsis finally saw him he was far out on the lake.

Akaiyan and the beaver returned



Beaver Pond Succession, NPS photos (Glacier NP Digital Image Library).

to his people and told their story. Together they assembled the Sacred Beaver Bundle as they had been instructed to do by the Beaver Chief. They spent the following winter teaching The People the sacred songs, dances, and ceremonials. They cured many people using their new powers. In the spring they went out into the forests and prairies and asked all the animals to contribute their mysteries and power to the Beaver Bundle. The animals were honored to take part and offered their skins to be included in the bundle. They also taught Akaiyan and Little Beaver their own power songs and dances to be shared with the people.

After a year, Akaiyan returned to the island to give Little Beaver back to his family and to visit his friends. On the shores of the island he found the bones of his brother Nopatsis. The beavers had not helped him. So pleased was the Beaver Chief to see his adopted son and to have his child back, that he gave Akaiyan a sacred pipe in which to smoke the sacred tobacco he had given him. He taught him more smoke prayers and instructed him to add the pipe to the Beaver Medicine Bundle. Every year Akaiyan returned to the island to visit his father the Beaver Chief.

Every year his father taught him more of The Way to live and to heal. Every year something new was added to the sacred bundle. Akaiyan became the leader and the teacher of his people. He lived in the Sacred Beaver Lodge and he taught his son the great mysteries and powers of The Beaver Medicine Ceremonial. Akaiyan's son passed the knowledge on to his son and so on until this very day.

## The Grizzly Chooses a Stepson [3] (A Kootenai Story)

Once in the old days, when a band of Ktunaxa were moving camp, a young boy was inadvertently left behind. He tried to catch up with his family but soon gave up and laid down on the trail in his despair and loneliness. Soon a large grizzly and two cubs happened across the miserable boy who immediately gave himself up for dead. "Move off the trail," commanded the great sow, but the young boy held his head down and refused to move. "Oh well," said the great grizzly and moved on around the boy. The smaller cub, however, begged his mother to keep the human for a playmate. The kind mother complied. She cuffed the boy lightly on the stomach with her left paw and said, "Come along now, I'll teach you to live like us."

In the Moon When Leaves Fall and the Geese Fly South, the mother bear instructed her children to empty their stomachs and prepare to den for the time of snows. With each new moon she awakened the three little ones and told them to roll onto their other side. One night the young boy awoke to the sound of a chinook wind outside the den. The mother grizzly sat on her haunches and sang softly along with the wind. "Arise, my little ones," she whispered, "The People are asking for our help." She explained that the People in their encampment were gathering with their medicine bundles and pipes to pray to the bears that they might be granted food, safety, and good fortune in the upcoming hunting and gathering season. During their ceremony the People sang their power songs to the accompaniment of a deer-hoof rattle staff. "We must go now and listen to their prayers," said the great grizzly. She and the cubs left

## The Grizzly Chooses a Stepson[3] (A Kootenai Story) Continued

the boy alone in the den.

Early in the morning the bears returned laden down with the stems from the sacred medicine pipes of the People. One by one they examined the stems. From their smells, the bears could tell whether an individual was sincere and truly in need or merely going through the motions and making a mockery of the bears. The stems of those with good hearts were placed in a large pile to the left; the stems of those who were insincere were isolated on the right. The insincere would have bear trouble during the coming year. Then the four of them laid down to sleep until awakened by the first thunder of the new season.

Mother grizzly instructed the young ones to mend their moccasins and to fill up on the fresh green shoots of grass along the snowbanks. All that season, the young boy continued to make the rounds with the grizzlies to learn their ways and absorb their power. When the snows came again, he returned with them to the den. When the bears awoke and went to attend the ceremonial, the boy found that he now had the power to hear the singing and dancing of the People. When the bears returned with the stems, he was able to help in reading them. It was with great pleasure that the boy recognized his own father's stem and saw that the great grizzly placed it on her left with those of the sincere.

This time, when the bears were awakened by the First Thunder When the Grass Begins to Grow, the great grizzly told him that it was time to return to his people. "Now you know the truth of these ceremonies. Tell the People to pray hard in order to please us. Some of them are not sincere." The boy was told that he would become a great leader of his people, that he would live in the Sacred Bear Tipi, and that he should

Female Grizzly with three cubs of the year, Don White Jr. photo (Glacier NP Digital Image Library).

## The Grizzly Chooses a Stepson[3] (A Kootenai Story) Continued

raise his son to carry on the ceremonial tradition for the People. Before he returned to his people, the bear gave him a special root to chew in order to control his wild nature. As the boy chewed, he walked down from the mountains and toward the valley where he knew the People to be encamped.

For many years, as he grew up, the young boy kept his experience to himself. When he finally married, he painted the Sacred Bear Lodge as the grizzly had instructed him. The People then recognized his supernatural power and came to him for instruction. He told them "I have this power from the grizzly. I will show how to properly take part in the ceremonial. Take care that you are sincere in your need and in your prayers. If you are sincere the bear will help you, but woe to him who has no faith."

## The Wildlife of Glacier National Park

Like plants, animals are affected by environmental influences such as landforms, climate, and availability of food and water. The great diversity found in the Glacier National Park area is mainly due to the overlap of habitats between the mountains and the prairie - and the great junction of five floristic provinces.

As human developments continue to fragment wildlife habitat, Glacier and other national parks have become more important to wild animals that require space, prey, and human tolerance. Nevertheless, even within the refuge of large parks, many species are so far ranging (birds, bears, wolves and ungulates, to name a few) that the long-term reality is the need for interagency cooperation in ecosystem management planning. The baseline information that the parks offer through monitoring and research comes to play once again. Review of the earliest records suggests that wildlife composition, at least for mammals and birds, has changed little since the park was established. Species known to have been extirpated include mountain bison and mountain or woodland caribou. Nonnative species include the ring-necked pheasant, rock dove, starling and house sparrow; however, none of these species is widespread or abundant. Raccoons and blue jays have expanded their ranges into the Glacier area as have the turkey (introduced in different areas of the state/province).

The park provides important year-round habitat for many wildlife species. Grasslands, shrub lands and riparian areas provide winter range for deer, elk and moose. Grasslands and forest environments provide spring range for deer, elk and grizzly bears. As spring progresses into summer, deer and elk move to higher elevations following the green-up of vegetation. The higher elevations also provide summer habitat for grizzly bears, bighorn sheep and goats. Low elevation valleys in the fall and spring provide habitat for almost all terrestrial wildlife species.

There are many documented migration routes for raptors (birds of prey) that follow mountain ranges and ridges in Glacier. These are significant travel corridors through which, using rising thermals and updrafts from the mountains, thousands of birds make their semi-annual migrations to winter or summer ranges. A vast majority of the birds are golden eagles, with some bald

eagles and hawks mixed in. During the autumn of 1996, over 3,000 raptors were counted at one site during September, October and November as they crossed high above the upper McDonald Valley. The parks may be along one of the largest golden eagle migration corridors in North America. This needed air space, a necessity for what some researchers indicate are declining populations of raptor species, is an interesting and no less important "habitat" requirement that must not be compromised by inappropriate human activities, especially within the protected "domain" of a national park. This is an excellent example of a management concern that requires cooperation among varying interest groups and managing agencies.

[1] Glacier National Park. *At Home in This Place*. St. Mary: National Park Service Visitor Center Exhibits, 2010.

[2] Glacier National Park. *Work House: A Glacier National Park Science Education Program*. West Glacier: National Park Service, 1992, 1998.

[3] Schaeffer, Claude E. *Bear Ceremonialism of the Kutenai Indians*. Browning, MT: Indian Arts and Crafts Board, 1966. The Grizzly story version printed here varies only slightly from "The Bear Foster Parent" as written in Schaeffer's book. He said the story was related to him by Abraham Bullrobe. The Kootenai Culture Committee, in *Ktunaxa Legends*, has a written version, called "Three Years with the Grizzly Family."

Bald Eagle, NPS photo (Glacier Student Guide CD).

## Vocabulary

Abandoned - to leave and never return to (someone who needs protection or help).
Baseline Information - information or data gathered at the beginning of a period from which variations that subsequently develop are compared
Diversity - a range of different things.
Ecosystem - a group of interconnected parts, formed by the interaction of a community of organisms with their environment.
Extirpation - to remove or destroy totally; do away with; exterminate.
Floristic provinces - classifying regions by their relatively uniform composition of plant species.
Inadvertently - accidentally.
Interagency - something that involves two or more agencies.
Mountain bison - American bison taxonomy has been a controversial issue for many years and classification to the subspecies level remains a matter of debate [11,53]. However, most authorities recognize two subspecies, the plains bison (Bos bison bison) and the wood bison (B. bison athabascae Rhoads) [11,34,53].
Plotted - secretly make plans to carry out.
Raptors - a bird of prey, e.g., an eagle, hawk, falcon, or owl.
Riparian - of, relating to, or situated or dwelling on the bank of a river or other body of water.
Sacred lodge - tipi with a painted design that has special significance or power and that is treated with great respect.
Spring range - the region where a free wondering animal is normally found in the springtime.
Supernatural - attributed to some force beyond scientific understanding or the laws of nature
Terrestrial - living or growing on land or on or in the ground; not aquatic, arboreal, or epiphytic.
Thermals - an upward current of warm air, used by gliders, balloons, and birds to gain height.
Woodland caribou - a large, dark brown caribou (Rangifer tarandus subsp. caribou) of forested areas of Canada and the northern United States.

## Checking for Understanding

1. Do you think people will follow the request of the Salish to only tell Coyote stories in winter- why or why not? If not, how could that be improved?
2. What do beavers and people have in common? How do people treat beavers today?
3. What similarities are there between the beaver story and the grizzly bear story?
4. Why is it necessary for Glacier National Park to work with other agencies (such as national forests, state lands, tribes, international wildlife agencies, and others) to manage wildlife?
5. How can the great diversity of wildlife in Glacier National Park be preserved and protected?